DAMES & MOORE
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CONSTRUCTION COMPLETION REPORT

Prepared for:
ORMET PRIMARY ALUMINUM CORPORATION
HANNIBAL, OHIO

JOB NO: 07983-039-120
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644 Linn Street, Suite 501
Cincinnati, Ohio 45203
Voice (513) 651-3440
Fax (513) 651-3452

ENGINEER CERTIFICATION

I, John D. Priebe, a Professional Engineer in the State of Ohio, hereby certify that the Remedial Construction Activities performed at the Ormet Primary Superfund Site have, to the best of my knowledge and belief, been completed in accordance with the *Final Design Report* dated February, 1997, *Technical Specifications and Drawings* dated February, 1997, *Construction Field Sampling Plan* dated Feburary, 1997, and *Construction Quality Assurance Project Plan* dated April, 1997, except as described in the accompanying report. This conclusion is based on observations made by Dames & Moore employees under my direct supervision and information provided by Ormet Primary and their respective contractors. Remedial Construction activities were substantially completed on June 12, 1998.

by ______________________________ Signature

8/10/98 ______________________________ Date

Ohio Professional Engineer License No. 56977

John D. Priebe, P.E.
Dames & Moore
644 Linn Street, Suite 501
Cincinnati, Ohio 45203

(513) 651-3440

STATE OF OHIO
JOHN
D.
PRIEBE
E-56977
REGISTERED
PROFESSIONAL ENGINEER

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REMEDIAL CONSTRUCTION COMPLETION REPORT

ORMET PRIMARY SUPERFUND SITE
HANNIBAL, OHIO

1.0 INTRODUCTION

This Remedial Construction Completion Report presents information to support the certification of remedial construction activities associated with the Ormet Primary Aluminum Corporation (Ormet Primary) Superfund Site in Hannibal, Ohio. The contents of this report and the attached certification are based on observations made by Dames & Moore engineers and field technicians, material information submitted by suppliers, and the results of field and laboratory testing performed on various materials during construction.

2.0 SITE OVERVIEW AND BACKGROUND

The Ormet Primary Superfund Site (Figure 1) is located adjacent to the Ormet Primary aluminum reduction facility (reduction facility) in Monroe County, Ohio, approximately 2.5 miles north of Hannibal. The site is situated on the west bank of the Ohio River, and occupies an area of approximately 47 acres east of the reduction facility.

A brief summary of information regarding the specific areas of interest is presented below. The location of the areas of interest are depicted on Figure 2. For additional information regarding the site, the reader should refer to the agency approved *Remedial Investigation (RI) Report (Geraghty & Miller, December 1993) and Final Design Report* (Dames & Moore, February 1997).

2.1 FORMER SPENT POTLINER STORAGE AREA

The Former Spent Potliner Storage Area (FSPSA) is located in the northeast portion of the Ormet Primary site, between the site access road and former Disposal Pond 5. The topography of the FSPSA is predominantly gently sloping toward the south. During the period of 1958 to 1981, spent potliner was stored in two separate piles located north and south of the unpaved access road. Approximately 85,000 tons of potliner were placed in the area for storage between 1958 and 1968. During 1968 to 1981, Ormet Primary used an on-site cryolite-recovery plant to process spent potliner that was being generated by manufacturing operations. During 1968 to 1981, Ormet Primary used construction equipment to load spent potliner from the FSPSA into trucks for transport to the cryolite-recovery plant. While spent potliner in the FSPSA was removed, a small portion of the spent potliner material was broken and crushed during handling by construction equipment and has been mixed into the underlying soil. Shallow soil within the FSPSA is the predominant source of groundwater alterations to the alluvial aquifer.

2.2 CARBON RUNOFF AND DEPOSITION AREA

The Carbon Runoff and Deposition Area (CRDA) is a formerly wooded area of the plant bordered on the west by the toe of the slope below the plant fence line between wells MW-3 and MW-40, on the east by the toe of the Construction Materials Scrap Dump (CMSD), on the north by the fence line south of Ponds 1 and 2, and the south by the Ohio River. The deposits of carbon material in this area ranged from less than 1-foot to approximately 5 feet thick and appear to have been carried into this area by stormwater runoff from the area around the anode crushing mill.

2.3 BACKWATER AREA

The Backwater Area is located at the mouth of the Outfall 004 stream and is bordered to the west by the CRDA, the east by the CMSD, and south by the Ohio River. The Backwater Area received stormwater runoff from areas of the plant, the CRDA, the CMSD, and wastewater discharges from Outfall 004. These processes resulted in the accumulation of sediment within the area that exhibit detectable levels of PCBs and polynuclear aromatic hydrocarbons (PAHs).

2.4 CONSTRUCTION MATERIALS SCRAP DUMP (CMSD)

The CMSD covers an area of approximately 4 to 5 acres on the southeastern portion of the Ormet Primary property. The CMSD occupies an area that was formerly a terrace above the Ohio River floodplain. The CMSD operated from approximately 1959 to 1979. During that time, the unit received a variety of material and debris from plant operations. As discussed in the Remedial Investigation report, materials that were potentially (but not necessarily) disposed include furnace brick, wooden pallets, petroleum coke fines and anode production scrap, miscellaneous demolition debris, petroleum products, plant trash, discarded electrical components, motor shop wastes, discarded mechanical components, discarded raw materials, and spent potliner. The materials were typically transported by truck, then dumped and spread over the ground surface.

In 1995, Ormet Primary negotiated a Consent Decree for implementation of the Remedial Design and Remedial Action activities at the site. The Final Design for the selected Remedial Action was approved by U.S. EPA on April 15, 1997. The approved remedial design consists of the following documents:

- *Final Design Report* dated February, 1997,
- *Technical Specifications* dated February, 1997,
- *Construction Field Sampling Plan* dated February, 1997, and
- *Construction Quality Assurance Project Plan* dated April, 1997.

These documents detailed the technical requirements for implementation of the remedial construction activities.

3.0 OVERVIEW OF CONSTRUCTION ACTIVITIES

As discussed in the approved design documents, the construction activities were separated into two discrete phases in order to provide a mechanism for agency review of specific remedial construction materials and protocols prior to their implementation. The Phase I construction activities were performed in March through April, 1997. In summary, Phase I (pre-construction activities) consisted of:

- Preparation of the Health & Safety/Contingency Plan,
- Preparation of the Backwater Area Isolation Structure submittal, and
- Finalization of the Construction Quality Assurance Project Plan.

Following review and/or approval of the Phase I pre-construction documents, Phase II construction activities were implemented. Phase II construction activities were conducted from May 1997 to June 1998. In summary, Phase II construction activities consisted of:

- Site Preparation,
- Removal of contaminated material from portions of the CRDA,
- Recontouring the CMSD,
- Installation of the CMSD Collection and Treatment System,
- Construction of the TSCA Cell,
- Relocation of Outfall 004 discharge,
- Removal of contaminated sediment from Backwater Area,

- Installation of the FSPSA Soil Flushing System,
- Construction of the site fencing, and
- Site restoration.

The Phase I and Phase II activities were performed in substantial accordance with the approved Final Design, except as noted herein. Additional information regarding implementation of the remedial construction activities is presented in the following sections.

The Ormet Primary retained O'Brien & Gere Technical Services, Inc. (O'Brien & Gere) of Syracuse, New York as the remedial contractor for the project. Several subcontractors were retained by O'Brien & Gere to implement specialized construction tasks and to perform the required independent quality control testing and surveying activities. O'Brien & Gere retained Geo-Synthetics, Inc. (GSI) of Waukesha, Wisconsin to install the TSCA Cell and CMSD geosynthetic materials (geosynthetic clay liner, high-density polyethylene liner, and synthetic drainage material). O'Brien & Gere also retained Professional Service Industries, Inc. (PSI) of Parkersburg, West Virginia to provide construction quality control for the earthwork on the project. Vernon Surveying Company (Vernon) of Marietta, Ohio was retained to provide the required surveying services.

Ormet Primary retained Dames & Moore to fulfill the role of the Quality Assurance Firm described in the technical specifications and Construction Quality Assurance Project Plan. Dames & Moore retained Precision Environmental Laboratories (PEL) of Orange, California to perform the required destructive testing on the liner samples.

In addition to the organizations listed above, Ormet Primary also retained Hydrosystems Management, Inc. to perform the monitoring well abandonment activities and Kemron Environmental Services, Inc. (Kemron) to perform the required verification sample analytical activities.

4.0 PHASE I - PRE-CONSTRUCTION ACTIVITIES

The Phase I - Pre-Construction Activities were initiated in March 1997 and were substantially completed by June 1997. The Phase I - Pre-Construction Activities consisted of preparation of the *Construction Health and Safety/Contingency Plan*, preparation of the *Backwater Area Isolation*

Structure Plan, and finalization of the *Construction Quality Assurance Project Plan.* These documents were submitted to the U.S. EPA during the Pre-Construction Conference on April 29, 1997.

As part of the Pre-Construction Activities, an investigation of potential borrow materials was also implemented. This investigation was performed to identify materials that achieved the project specifications for the various earthen and aggregate materials to be used on the project. These materials consisted of silty clay fill material, fine-grained subgrade material, drainage material, and vegetative soil material.

O'Brien & Gere proposed to obtain the silty clay fill material, fine-grained subgrade material, and vegetative soil material from a on-site borrow area. The borrow area was located to north of State Route 7, immediately across from the Ormet Primary Reduction Facility. Soil samples were obtained from test pits installed in the proposed borrow area. The results of this investigation indicated that the borrow materials achieved the specification requirements for Silty clay fill material ($k \leq 1 \times 10^{-5}$ cm/sec), fine-grained subgrade material, and vegetative fill. Further information and geotechnical testing results of the proposed materials is provided in Appendix A.

In addition to the initial investigation testing, the technical specifications and *Construction Field Sampling Plan* required that supplemental moisture density relationship testing (ASTM D-698), Liquid and Plastic Limit testing (ASTM D-4318), and material finer than the No. 200 sieve testing (ASTM D-1140) be performed for every 5,000 cubic yards of silty clay fill material and fine-grained subgrade material placed. These supplemental testing results have also been provided in Appendix A.

O'Brien & Gere proposed to utilize Grimes Borrow Pit in Grandview, Ohio as the source of drainage material for the TSCA Cell leakage detection/groundwater monitoring layer and leachate collection system. Particle size and hydraulic conductivity testing performed on the proposed indicated that the proposed material achieved the requirements of the specifications. Testing results for the drainage material are provided in Appendix A.

5.0 PHASE II - CONSTRUCTION ACTIVITIES

The Phase II construction activities were initiated in April 1997 and were substantially completed in June, 1998. The Phase II construction activities consisted of:

- Site Preparation,
- Removal of contaminated material from portions of the CRDA,
- Recontouring the CMSD,
- Installation of the CMSD Collection and Treatment System,
- Construction of the TSCA Cell,
- Relocation of Outfall 004 discharge,
- Removal of contaminated sediment from Backwater Area,
- Installation of the CMSD and TSCA Cell cap,
- Installation of the FSPSA Soil Flushing System,
- Construction of the site fencing, and
- Site restoration.

These activities are described in the following sections.

5.1 SITE PREPARATION

The primary site preparation activities included erection of erosion controls, installation of the temporary treatment system, construction of the decontamination area, and abandonment of specified wells.

Prior to construction activities, silt fences were erected by O'Brien & Gere along the CMSD/Ohio River interface, the western perimeter of the CMSD, and along the southern perimeter of the CRDA. Silt fences were also placed along each bank of Outfall 004 temporary diversion channel alignment. These controls were maintained for the duration of the associated earthwork and excavation activities.

The technical specifications required that the contractor install and maintain a temporary treatment system during construction. The temporary treatment system was used to treat construction-derived wastewaters. These waters included liquids generated from Backwater Area detwatering activities, stormwater collecting in potentially contaminated excavation areas, and decontamination rinsate, etc. Prior to construction activities, O'Brien & Gere installed a temporary treatment system consisting of a 25,000 gallon storage tank, two 10 microgram bag filters (installed in parallel), and two 10,000 pound carbon vessels (operated in series). The system was capable of treating a flow rate of 100 gallons per minute. During the course of construction, construction-derived wastewaters were collected and treated in the system. The treated water was discharged to Outfall 004 under a modification to Ormet Primary's existing National Pollutant Discharge Elimination System (NPDES) permit.

In order to provide an area for equipment decontamination, a decontamination area was constructed immediately north of the CRDA limits. The decontamination area was constructed by constructing a berm of soil around the proposed decontamination pad area. A decontamination pad liner was then constructed which consisted of a 40-mil, high-density polyethylene liner. The decontamination area was utilized throughout construction until there was no longer the potential for equipment contact with potentially contaminated materials. Rinsate generated from operation of the decontamination area was pumped through the temporary treatment system. Following completion of equipment decontamination, the decontamination area residuals (i.e., liner, etc.) were placed beneath the CMSD subgrade.

As discussed in the approved design documents, several wells in the vicinity of the construction activities required abandonment. For wells designated for abandonment (MW-33D, MW-33S, MW-43S, and MW-43D), the well casings were overdrilled with hollow stem augers, and the bore hole grouted with bentonite grout from bottom to top with a tremie pipe as the augers were removed. Soil cuttings and monitoring well remnants were transferred to the CMSD and incorporated beneath the subgrade material. Documentation associated with the monitoring well abandonment activities is presented in Appendix B.

5.2 REMOVAL OF CONTAMINATED MATERIAL FROM CRDA

The Record of Decision required that material within the CRDA be excavated down to native soil, and, if appropriate (i.e., they exhibit a PCB concentration of 50 mg/kg or less), be consolidated within the CMSD prior to installation of the CMSD cap. For materials exhibiting a PCB concentration exceeding 50 mg/kg, the approved design documents permitted disposal of such materials within the constructed on-site TSCA disposal cell (discussed in Section 5.5). These actions would remove the potential for further migration of the carbon, and any associated hazardous substances, into the Backwater Area and/or Ohio River.

In order to sequence construction to permit construction of the CMSD, TSCA disposal cell, and relocation of the Outfall 004 discharge stream, the CRDA removal activities were implemented in three stages. Each stage of CRDA removal activities consisted of the following general activities:

- Installation of a temporary erosion and sediment controls,
- Excavation of carbon materials, below-ground vegetation, and underlying soil (as necessary), and placement of these materials within the limits of the CMSD. Suspected PCB-containing materials removed from the CRDA were placed within the TSCA disposal cell, or temporarily stockpiled within the CRDA or CMSD,
- Demonstration that CRDA Soil Cleanup Standards have been achieved through implementation of a verification sampling program,
- Spreading and compaction of stockpiled materials exhibiting PCB concentrations <50 ppm within the limits of the CMSD,
- Spreading and compaction of materials suspected of exhibiting PCB concentrations ≥ 50 ppm in the on-site TSCA disposal cell,
- Regrading the CRDA to drain into the relocated Outfall 004 discharge channel, as appropriate, and
- Revegetating areas disturbed by construction.

The Cleanup Standards for the CRDA are summarized on Table 1. These standards are applicable to all CRDA areas, with the exception of the Stage I CRDA area. The Stage I CRDA area was within the limits of the future CMSD cover system.

As previously discussed, the CRDA removal activities were performed in three stages in order to permit construction of the on-site TSCA disposal cell within the CMSD and efficient relocation of the Outfall 004 system. The approximate limits of the Stage I, Stage II, and Stage III removal areas are depicted on Figure 3. Discussion of each stage of CRDA removal is provided in the following sections.

5.2.1 Stage I CRDA Removal

The first stage of CRDA removal activities involved the removal of carbon materials (and underlying soils exceeding applicable cleanup standards) within the proposed CMSD regrading limits, and along the proposed Outfall 004 temporary drainage channel alignment. These activities were performed between May and June, 1997. The initial carbon/soil removal activities consisted of the excavation of all visible carbon within the proposed removal area. The excavated materials were temporarily staged in piles located within the limits of the CRDA (for future disposal in the constructed on-site TSCA Cell). The staged piles were protected with plastic sheeting and soil berms to prevent contact with precipitation and stormwater run-on.

Following removal of the visible carbon deposits within Stage I, a verification sampling program was implemented in accordance with the provisions of the *Construction Quality Assurance Project Plan.* The sampling program was performed to verify that the clean-standards for the site have been achieved. This program involved dividing each excavation area into a series of approximately 2,500 square foot (50 foot by 50 foot) grid areas. Shallow composite samples were then collected following the completion of each excavation iteration. The verification sampling program is further discussed in Appendix C.

Because the Stage I CRDA area was located within the footprint of the future CMSD cover system, the collected verification samples were required to exhibit PCB concentrations of less than 50 mg/kg. If the initial verification sampling results from any grid area indicated PCB concentrations exceeding 50 mg/kg, additional material was excavated from the corresponding area and additional verification samples were collected until all Stage I CRDA areas exhibited PCB concentrations less than 50 mg/kg. A summary of the Stage I CRDA verification sampling grid areas and results is provided on Figure 4. The Stage I CRDA verification sampling results are also summarized on Table 2.

As part of the Stage I CRDA excavation activities, carbon and underlying soils along the alignment of the temporary Outfall 004 drainage channel were also excavated and stockpiled. Following receipt of verification sample results (SS-1 and SS-2), a temporary drainage channel was constructed. Following diversion of the Outfall 004 effluent flow, the remaining portions of the former Outfall 004 drainage channel were backfilled with compacted silty clay fill from the on-site borrow area. The silty clay fill was placed in loose lifts up to 8-inch thick and was compacted to at least 95 percent of the material's Standard Proctor maximum dry density. A temporary stormwater diversion berm was also constructed adjacent to the proposed western CMSD regrading limit to minimize the potential for inundation of the CMSD regrading area by stormwater from Outfall 004. Due to moist subgrade conditions encountered in the vicinity of the temporary stormwater diversion berm, the initial soil lifts could not be placed in thicknesses of 8-inches or less as required by the technical specifications. Instead, the initial lifts were placed in thicknesses exceeding 8-inches in order to bridge over the soft materials and provide a suitable surface for subsequent compaction activities. The upper lifts of the temporary stormwater diversion berm were placed in 8-inch thick loose lifts and compacted to at least 95 percent of the material's Standard Proctor maximum dry density. Compaction testing reports are provided in Appendix A.

Completion of the CRDA Stage I removal activities enabled implementation of the CMSD regrading activities (discussed in Section 5.3).

5.2.2 Stage II CRDA Removal

Following completion of the Stage I CRDA removal activities, the Stage II CRDA removal activities were implemented. The Stage II CRDA removal activities were implemented in June and July, 1997.

The initial Stage II CRDA removal activities consisted of the excavation of all visible carbon, west of the Stage II removal boundary identified on Figure 3. During the initial excavation activities, the excavated materials were temporarily stockpiled (within unexcavated areas of the CRDA) for eventual disposal within the on-site TSCA Cell. Following removal of the visible carbon deposits, representative samples of the underlying soil were obtained to assess whether they exhibited PCB or PAH concentrations above the CRDA Soil Cleanup Standards presented in Table 1. Grid areas with associated samples exceeding the cleanup standards were subjected to further excavation. However, because initial verification sampling results indicated PCB concentrations less than 50 mg/kg for all collected samples, the additional excavated material from associated grid areas was transferred directly to within the limits of the regraded CMSD (rather than stockpiling for future TSCA Cell disposal). A summary of the Stage II CRDA verification sampling grid areas and results is provided on Figures 5 and 6. The Stage II CRDA verification sampling results are also summarized on Table 3. All Stage II CRDA verification samples exhibited PCB concentrations less than 1 mg/kg and carcinogenic PAH concentrations less than 60 mg/kg.

Completion of the Stage II CRDA removal activities enabled construction to begin on the permanent Outfall 004 discharge channel (discussed in Section 5.6).

5.2.3 Stage III CRDA Removal

Following completion of the Outfall 004 relocation (discussed in Section 5.6), contaminated material was removed from the remainder of the CRDA. The Stage III removal activities were performed in September and October, 1997. The removal activities were implemented in accordance with the same methodologies and standards utilized for the previous Stage II CRDA removal activities. However, because the on-site TSCA Cell construction activities were complete at the time of Stage III CRDA removal, the removed materials were transferred directly to the TSCA Cell.

A summary of the Stage III CRDA verification sampling grid area locations and results is provided on Figure 7. The Stage III CRDA verification sampling results are also summarized on Table 4. As shown on Figure 7, all samples collected from the Stage III CRDA area exhibited carcinogenic PAH concentrations less than the 60 mg/kg cleanup standard. All Stage III CRDA verification samples (except SS-75 and SS-78) exhibited PCB concentrations less than 1 mg/kg. Samples from grid areas SS-75 and SS-78 exhibited PCB concentrations of 5.3 mg/kg and 1.3 mg/kg, respectively. The approved design documents allow areas determined to have a PCB concentration between 1 and 10 mg/kg to be addressed through an alternate remedial action. This alternate remedial action involved the placement of a minimum 10-inch thick vegetative cover layer over the area, and seeding/mulching the surface to minimize the potential for future erosion and exposure. In accordance with this provision, a soil cover was placed over the entire area associated with grid areas SS-75 and SS-78. Survey information demonstrating the soil cover over these areas has a minimum thickness of 10-inches is provided on Table 5.

5.3 RECONTOURING THE CMSD

The Record of Decision required Ormet Primary to recontour and cap the CMSD with a cap that met the substantive requirements of RCRA Subtitle C landfill closure. Prior to construction of the cover system, the CMSD area was regraded to eliminate the steep slope adjacent to the Ohio River.

The CMSD was regraded to remove waste material located within approximately 15 feet of the current edge of the Ohio River, and to regrade the surface to a maximum slope of 25 percent (4 horizontal to 1 vertical). The regraded material was placed in the small valley in the western portion of the CMSD. The westernmost limit of the CMSD was established by the location of the CMSD seep collection system as shown on the design drawings (and described in Section 5.4). Material removed from other portions of the site (i.e., material from Stage II CRDA removal activities, New Cast House Area soil stockpiles, FSPSA debris and stained soil, etc.) deemed suitable for consolidation or use as subgrade material was also placed in this area. In additional, an approximately 180-foot by 150-foot area near the CMSD crest was shaped to form the proposed on-site TSCA Cell. The CMSD regrading activities involved the regrading of approximately 53,000 cubic yards of waste material. Regraded CMSD wastes were placed in approximately 2- to 3-foot thick individual lifts and compacted by a vibrating smooth drum roller or sheepsfoot roller.

Following completion of the rough grading activities, a subgrade layer was placed and compacted to provide support for the CMSD cover construction activities. The subgrade material was placed in maximum 8-inch thick loose lifts and compacted to 95 percent of the material's standard Proctor maximum dry density. The uppermost 6 inches of the subgrade were constructed using fine-grained subgrade material from the Route 7 Borrow Area. As required by the technical specifications, the fine-grained subgrade material was predominantly free of particles greater than 1/4-inch in size. Soils information and compaction testing reports are provided in Appendix A.

5.4 COLLECT AND TREAT CMSD SEEPS

The Record of Decision required that the identified CMSD seeps be remediated by the construction of seepage collection systems. The collection system consisted of gravel-filled trenches that were installed along portions of the CMSD perimeter. The approved design required that this collection system be installed only along the western perimeter of the CMSD. However, during regrading of the riverside (southern) portions of the CMSD, two isolated seeps were observed on the riverside face of the unit. In response to this conditions, the design of the seep collection system was modified to extend the collection system along the southern perimeter of the CMSD. This design modification was communicated to U.S. EPA in correspondence dated August 28, 1997.

The CMSD seep collection system was constructed by excavating shallow trenches along the western and southern perimeter of the unit. The trenches were lined with an 8-ounce layer of non-woven geofabric and filled with coarse aggregate material (ODOT No. 6 Stone). A 4-inch perforated HDPE drain pipe was installed within the stone to convey the collected seepage to a series of four 48-inch diameter HDPE sumps. Within each sump, a submersible pump (G&L Model 2ED11F4GA) was installed. The pump, operated by level controls, was installed to convey the collected seepage (via 2-inch polyethylene piping) to a pre-treatment system located adjacent to Ormet Primary's groundwater treatment plant. Following installation, the entire length of transfer piping was hydrostatically tested at 75 psi for 30 minutes as described in the *Construction Field Sampling Plan* and technical specifications. Copies of pipe testing logs are provided in Appendix D.

In accordance with the approved design, the installed pre-treatment system included units to remove sediments, oil and/or grease, and PCBs and other constituents amenable to adsorption on activated carbon. Sediments are removed through two particle filters (Rosedal Model 8 equipped with a 1 micron bag) operated in series. Following the bag filters, a oil adsorbent canister (containing Boni Fibers) was installed to remove oil and/or grease and two 390 pound granular activated carbon units, manufactured by EncoTech of Donora, Pennsylvania, were installed to remove PCBs and other organic constituents. From the carbon units, piping was installed in order discharge the pre-treated liquids to the Ormet Primary groundwater treatment plant.

5.5 CONSTRUCT TSCA CELL

Following completion of CMSD regrading activities in the immediate TSCA disposal cell vicinity, construction of the cell bottom was implemented. As discussed in the approved design documents, the bottom liner consisted, in ascending order, of:

- Lowermost barrier system
- Leakage detection layer/groundwater monitoring layer
- Primary liner, and
- Leachate collection system.

Additional information regarding each of these components is presented in the following sections.

5.5.1 Lowermost Barrier System

The lowermost barrier is a composite barrier system, consisting of a minimum 1-foot thick silty clay soil subgrade, geosynthetic clay layer, and HDPE liner. Additional information on each of these layers is provided in the following section.

Silty Clay Soil Subgrade Placement

The silty clay soil subgrade was constructed by spreading Silty Clay Fill material from the Route 7 Borrow Area in loose lifts, 8-inches thick or less, and conditioning the soil to an appropriate moisture content for compaction (-2 to +2 percent of optimum). The material was then compacted, using sheepsfoot rollers, to at least 95 percent of it's Standard Proctor maximum dry density. Compaction reports for this layer are provided in Appendix A. The subgrade surface was then proof-rolled to provide an acceptable surface for the geosynthetic clay liner.

The provisions of the *Construction Field Sampling Plan* required that survey information be collected on a 50-foot grid system to document the thickness of the silty clay soil subgrade. A summary of the survey information collected by Vernon Surveying documenting the thickness of the silty clay soil subgrade is provided on Table 6. The survey information confirmed that at least 1 foot of Silty Clay Fill was placed at each location.

Geosynthetic Clay Liner Installation

Following subgrade preparation activities, a geosynthetic clay liner (GCL) was placed over the limits of the TSCA Cell base. The GCL utilized for the project was Bentofix manufactured by Albarrie Naue Ltd. of Barrie, Ontario. Prior to installation, the results of material testing performed by the manufacturer for the rolls of GCL delivered to the site were reviewed to verify that the GCL met the requirements listed in the *Construction Field Sampling Plan.* The manufacturer's testing results are presented in Appendix E.

The GCL was placed, non-woven geofabric side down, over the entire TSCA Cell limits by GSI. The GCL was placed to conform with the existing subgrade surface and the panels were oriented parallel to the direction of slope. Adjacent panels of GCL were overlapped at least 6 inches. The GCL was installed in accordance with the manufacturer's recommendations and the *Construction Field Sampling Plan.* Documentation of the QA/QC observations during installation of the GCL are presented in Appendix E.

High Density Polyethylene Liner Installation

In order to maximize the effectiveness of the lowermost barrier system, the approved design required the placement of a textured 60-mil high density polyethylene (HDPE) liner over the GCL surface. This component of the lowermost barrier system was installed using textured 60-mil HDPE manufactured by Columbia Lining Systems of Calgary, Alberta. The HDPE liner was installed directly on top of the GCL liner. Prior to installation of the synthetic liner, GSI provided Dames & Moore with the manufacturer's quality control certificates on the HDPE liner and raw materials used in its production. These certificates are included in Appendix E.

The liner rolls were deployed using a spindle-equipped rubber-tired front-end loader and manual labor. The individual HDPE liner panels were oriented parallel to the direction of slope, and adjacent liner panels were overlapped at least 4 inches for seaming. Seams were joined using the double fusion process, whereby the surfaces of adjacent liner panels are melted by a heating element, then pressed together by a trailing roller. The seam produced from the double fusion welding process consists of two fusion weld seams separated by an area of double liner thickness with an entrapped air channel. Repair areas and other difficult welding areas were seamed using the extrusion welding process, whereby a ribbon of molten polymer is extruded between adjacent liner sheets that have been preheated with an electrode from the welding machine. As the molten polymer cools, it creates a relatively homogeneous seam.

At the beginning of each day's welding, test welds were run from each piece of welding equipment using pieces of HDPE liner and tested to destruction by a field tensile test machine. Once these test welds were approved, GSI personnel initiated seaming of the liner. Dames & Moore personnel observed the seaming process and inspected completed seams in order to identify areas of questionable quality. Weld imperfections, destructive sample locations, and liner punctures were marked and subsequently repaired by extrusion welding of an HDPE liner patch over the area in question. All extrusion welded seams were non-destructively tested along their entire length, utilizing a vacuum box, in order to evaluate their integrity. Documentation of non-destructive testing is presented in Appendix E.

Air pressure testing was used as the primary means of evaluating the integrity of the double-fusion welded seams. This method involved pressurizing the channel between the fusion weld tracks and observing a gauge to detect loss of pressure, if any. Each seam was pressurized with air to approximately 25 to 30 pounds psi and monitored for at least 5 minutes. An allowable pressure loss of 5 psi was tolerated to account for potential expansion of the material due to the applied pressure or variations in temperature (i.e., heating). Seam pressure testing results are summarized in Appendix E. All double fusion welded seams passed the air pressure test. At the end of each seam test, a pin-size hole was made in the test channel at the extreme end of the seam to verify that the seam being tested extended the full length of the weld. Instantaneous loss in pressure was detected upon this puncturing of each test channel indicating that the test results were applicable to the entire seam, and serving as an indicator of the high sensitivity of the test in evaluating the presence of small leaks.

In order to further document the integrity of the field-constructed seams, destructive testing was performed on representative samples of the field seams. The destructive testing was performed for bonded seam strength and peel adhesion by Precision Environmental Laboratories of Orange, California. Testing results on the collected HDPE liner destructive samples are summarized in Appendix E. With the exception of samples DES-4 and DES-7, all destructive samples passed, indicating that the field seams were constructed in accordance with the required construction specifications and *Construction Field Sampling Plan*.

The following explanation is provided with regard to failing samples DES-4 and DES-7. On August 2, 1997, the site experienced a brief period of very light rain during liner extrusion welding activities. In response to this condition, field Quality Assurance personnel requested that a destructive sample be collected (DES-4) from the portion of the field seam which was extrusion welded during this period. The DES-4 testing result indicated peel adhesion results which did not conform to the project requirements. In an effort to bound the non-conforming seam area, additional destructive samples (DES-6 and DES-7) were then collected approximately 20 feet to the east and west of sample location DES-4. While DES-6 indicated acceptable results, sample DES-7 indicated peel adhesion results which did not conform to the project requirements. In accordance with the project requirements, the contractor elected to install a cap strip from DES-6 to the end of the seam installed on August 2, 1997. Vacuum box testing results of the cap strip indicated acceptable results.

5.5.2 Leakage Dection Layer/Groundwater Monitroing Layer Installation

In order to permit discrete monitoring of water beneath the TSCA Cell, a leakage detection/groundwater monitoring layer was installed. The base of the layer was sloped to a sump to permit collection of water, if any, that may migrate through the liner system.

The installed monitoring system consisted of a 12-inch thick sand drainage layer placed over the gently sloping cell bottom, and a synthetic drainage net installed on the steeply graded cell sideslopes. The material for the sand drainage layer ($k \geq 1 \times 10^{-2}$ cm/sec) was supplied from the Grimes Borrow Pit in Grandview, Ohio. Hydraulic conductivity and particle size testing results are provided in Appendix A. The drainage layer was placed in a single lift using a low ground pressure bulldozer. Following placement, thickness measurements were collected to verify the layer exhibited the minimum thickness of 12 inches. These measurements are summarized on Table 7. As shown on Table 7, all collected measurements indicated layer thickness of at least 12 inches.

As mentioned above, a layer of synthetic drainage net was installed on the steeply graded cell sideslopes. The synthetic drainage net, Poly-Net 3000 as manufactured by the National Seal Company, was installed parallel to the direction of slope. Overlapping and seaming of the synthetic drainage net was performed in accordance with the manufacturer's recommendations.

5.5.3 Primary Liner

The primary liner consisted of a 60-mil textured HDPE liner manufactured by Columbia Lining Systems. The primary liner was installed utilizing the same materials, and installation and quality control procedures discussed in Section 5.4.1. Quality assurance observations and testing results on the collected HDPE liner destructive samples are summarized in Appendix E. All destructive samples passed, indicating that the field seams were constructed in accordance with the required construction specifications and *Construction Field Sampling Plan.*

5.5.4 Leachate Collection Layer

The leachate collection layer was construction in a similar manner to the leakage detection/groundwater monitoring layer discussed in Section 5.4.3. The layer consisted of a 12-inch thick sand drainage layer on the gently sloping cell base and a synthetic drainage net installed over the steep cell sideslopes. The sand drainage layer was placed in a single lift using a low ground pressure bulldozer. Following placement, thickness measurements were made to verify the layer exhibited the minimum thickness of 12 inches. These measurements are summarized on Table 7. As shown on Table 7, all collected measurements indicated a layer thickness of at least 12 inches.

A layer of synthetic drainage net was installed on the steeply graded cell sideslopes. The synthetic drainage net, Poly-Net 3000 as manufactured by the National Seal Company, was installed parallel to the direction of slope. Overlapping and seaming of the synthetic drainage net was performed in accordance with the manufacturer's recommendations.

Following installation of the drainage materials, a non-woven geofabric layer was installed directly over the drainage layer. In accordance with the project requirements, adjacent sheets were overlapped a minimum of 24 inches.

5.6 RELOCATE OUTFALL 004 DISCHARGE

In order to mitigate the potential for stormwater inundation of the Backwater Area during removal and consolidation activities, it was necessary to relocated the Outfall 004 discharge stream. This was accomplished through the construction of a new drainage channel.

In order to manage the Outfall 004 flow, a new drainage channel was constructed through the western limit of the CMSD to discharge directly to the Ohio River. The trapezoidal channel was constructed using Silty Clay Fill material from the Route 7 Borrow Area. The technical specifications required that the material be placed in 8-inch lifts and compacted to 95 percent of the material's Standard Proctor maximum dry density. Due to moist subgrade conditions encountered in the vicinity of the temporary stormwater diversion berm, the initial soil lifts could not be placed in thicknesses of 8-inches or less as required by the technical specifications. Instead, the initial lifts were placed in thicknesses exceeding 8-inches in order to bridge over the soft materials and provide a suitable surface for subsequent compaction activities. The upper lifts of the channel were placed in 8-inch loose lifts and compacted to at least 95 percent of the material's standard Proctor Maximum dry density. Compaction testing reports are provided in Appendix A. Following completion of earthwork activities, 6-inch thick stone-filled wire mattresses were installed along the channel flow surface in accordance with the technical specifications.

The *Construction Field Sampling Plan* required that survey information be collected at 100-foot stations to document channel grade. The plan further required that channel invert grades be within +/- 0.2 feet of the design elevation. A summary of the design and surveyed channel invert elevations is provided on Table 8. As shown on Table 8, several of the surveyed invert elevations did not achieve the required +/- 0.2 foot tolerance. However, based on field observations, the channel appeared to function effectively, and this minor variance was not deemed to adversely affect the performance of the Remedial Action.

5.7 REMOVE CONTAMINATED SEDIMENT FROM BACKWATER AREA

The approved design documents required that contaminated sediment be removed from the Backwater Area and consolidated within the CMSD (i.e., they exhibit a PCB concentration less than 50 mg/kg) or TSCA Cell. The sediment removal activities were required to continue until achievement of the Backwater Area Cleanup Standards summarized on Table 1.

In order to inhibit the potential for adverse impact to the Ohio River from the sediment removal activities, provisions were made to divert stormwater drainage and the Outfall 004 discharge (described in Section 5.6) around the Backwater Area. In addition, in order to minimize the potential for inundation of the area during sediment removal operations, the Backwater Area was isolated from the Ohio River by an earthen isolation structure. The isolation structure was installed in accordance with the *Backwater Area Isolation Structure Plan*. The structure was constructed by first placing a layer of non-woven geofabric across the mouth of the Backwater Area. Following geofabric installation, silty clay fill from the Route 7 Borrow Area was placed and compacted over the geofabric layer. The isolation structure was installed to elevation 624 in order to prevent inundation of the area from a 1-year flood event (with 2 feet additional free-board for wave action). Sheet piling was also installed on the riverside of the isolation structure to minimize seepage into the Backwater Area. Following construction of the isolation structure and during excavation activities, water within the Backwater Area (and temporary dewatering sumps) was pumped to the temporary treatment system.

Once the area was isolated, the sediment removal activities were performed. The sediment materials were removed using trackhoes operating from the isolation structure and banks of the unit. Removed sediment materials were transferred directly to the TSCA Cell for disposal. Due to the high moisture content of the removed sediment materials, a stabilization program was implemented. The program involved mixing the sediment materials with a pozzolanic material (i.e., Pozzilime) to stabilize the matrix. Following stabilization, the excavated materials were spread in thin lifts (i.e., 1 foot or less) and lightly compacted.

Following removal of potentially impacted sediments from the Backwater Area, representative samples of the underlying soil were obtained to assess whether they exhibited PCB or PAH concentrations above the Cleanup Standards in Table 1. In the event that any sample exceeded the cleanup standards, the grid area associated with that samples was subjected to further removal and verification testing. Further information regarding the verification sampling program is provided in Appendix C. A summary of the Backwater Area verification sampling grid areas and results are provided on Figures 8 and 9. The Backwater Area verification sampling results are also summarized on Table 9. All Backwater Area verification samples exhibited PCB concentrations less than 1 mg/kg and carcinogenic PAH concentrations less than 60 mg/kg.

During Backwater Area removal activities, approximately 8,500 cubic yards of material were consolidated within the TSCA Cell. These activities resulted in excavation of the former Backwater Area (and immediately adjacent areas) to a depth of approximately 25 feet. The approved design did not address backfill of this area. In order to mitigate concerns regarding the long-term stability of adjacent areas (especially the nearby CMSD), Ormet Primary elected to backfill the area. The area of the former Backwater Area was backfilled with fill from the Route 7 Borrow Area to approximately 1 to 2 feet above normal river pool. Following substantial backfill of this area, the installed sheet piling installed on the outer face of the isolation structure was removed, and the remainder of the isolation structure was left in place. To facilitate surface water drainage, areas adjacent to the former Backwater Area were graded to drain into a swale near the western limit of the CMSD. An outlet pipe was installed through the isolation structure to permit discharge of the stormwater to the Ohio River. In order to protect the isolation structure from erosion due to wave action, rock erosion protection was placed along the riverside face of the structure. These modifications were communicated to U.S. EPA in correspondence dated December 22, 1997.

5.8 INSTALLATION OF THE CMSD AND TSCA CELL

Following completion of the contaminated material excavation and disposal activities and subgrade approval, the contractor installed the dual-barrier cap system over the TSCA Cell and CMSD. With regard to TSCA Cell cap subgrade preparation activities, it should be noted that areas of the fine-grained subgrade material (placed over consolidated sediment material from the Backwater Area) were observed to experience displacement under the loads of operating construction equipment. In response to this condition, the subgrade was reinforced with a biaxial geogrid material (i.e., Tensar BX1100) and additional fine-grained subgrade material was placed over the area. These actions were effective in achieving the required subgrade stability and compaction characteristics. U.S. EPA was informed of this modification in correspondence dated April 14, 1998.

In accordance with the approved design, the dual-barrier cap system over the TSCA Cell and CMSD included, from bottom to top, the following components:

- A low permeability barrier consisting of a geosynthetic clay liner,
- A synthetic liner system consisting of a 40-mil HDPE liner,
- A drainage layer,
- A vegetative soil layer, and
- Erosion protection.

Additional information regarding each of these components is provided below.

5.8.1 Low Permeability Barrier

The secondary cover barrier consisted of a geosynthetic clay liner (GCL). The GCL utilized for the project was Bentofix manufactured by Albarrie Naue Ltd. of Barrie, Ontario. Prior to installation, the results of material testing performed by the manufacturer for the rolls of GCL delivered to the site were reviewed to verify that the GCL met the requirements listed in the

Construction Field Sampling Plan. The manufacturer's testing results and are presented in Appendix E.

The GCL was placed, non-woven geofabric side down, over the entire CMSD and TSCA Cell limits by GSI. The GCL was placed to conform with the existing subgrade surface and, on the steep unit sideslopes, the panels were oriented parallel to the direction of slope. Adjacent panels of GCL were overlapped at least 6 inches. The GCL was installed in accordance with the manufacturer's recommendations and the *Construction Field Sampling Plan.* Documentation of the QA/QC observations during installation of the GCL are presented in Appendix E.

5.8.2 Synthetic Liner System

The primary cover barrier system consisted of a textured 40-mil HDPE liner system manufactured by Columbia Lining Systems of Calgary, Alberta. The HDPE liner was installed directly on top of the GCL liner. Prior to installation of the synthetic liner, GSI provided Dames & Moore with the manufacturer's quality control certificates on the HDPE liner and raw materials used in its production. These certificates are included in Appendix E.

The liner rolls were deployed using a spindle-equipped rubber-tired front-end loader and manual labor. On the steep sideslopes, the individual HDPE liner panels were oriented parallel to the direction of slope, and adjacent liner panels were overlapped at least 4 inches for seaming. Seams were joined using the double fusion process, whereby the surfaces of adjacent liner panels are melted by a heating element, then pressed together by a trailing roller. Repair areas and other difficult welding areas were seamed using the extrusion welding process. All other installation and QA/QC procedures were similar to those described in 5.5.1.

Destructive testing results on the collected HDPE liner samples are provided in Appendix E. All destructive samples passed, indicating that the field seams were constructed in accordance with the required construction specifications and *Construction Field Sampling Plan.*

5.8.3 Drainage Layer

The approved design included a drainage layer consisting of a 12-inch granular drainage layer ($k \geq 1 \times 10^{-2}$ cm/sec). Due to the limited local availability of a cost-effective material (coarse sand and/or gravel) which achieved the project requirements, the design was modified to permit utilization of a synthetic drainage net in lieu of the granular drainage layer. As part of this revision, the vegetative soil layer thickness was also modified from 18-inches to 24 inches. U.S. EPA was informed of these revisions in correspondence dated July 9, 1997 and September 16, 1997.

A layer of synthetic drainage net (Poly-Net 3000 as manufactured by the National Seal Company) was installed over the entire TSCA Cell/CMSD subgrade. On the steep CMSD sideslopes, the synthetic drainage net was installed parallel to the direction of slope. Overlapping and seaming of the synthetic drainage net was performed in accordance with the manufacturer's recommendations.

During drainage net installation activities, a variance was identified with regard to the interface friction properties between the HDPE liner and the synthetic drainage net. The technical specifications required that the interface between the HDPE liner and synthetic drainage material exhibit a friction angle of at least 20.5 degrees. However, testing results provided by the contractor indicated that the interface between the 40-mil HDPE liner exhibits a peak friction angle of 18 degrees, with adhesion of 4 pound per square foot. Calculations using the test data indicated that the as-built CMSD cover system had a minimum factor of safety of 1.36 against sliding, rather than the design value of 1.5. In response to this data, Ormet Primary petitioned U.S. EPA requesting a design variance on the required friction angle for this interface. This design variance was approved by U.S. EPA in correspondence dated March 30, 1998. A copy of correspondence and calculations associated with this issue has been provided in Appendix F.

Following installation of the drainage materials, a non-woven geofabric layer was installed directly over the drainage layer. In accordance with the project requirements, adjacent sheets were overlapped a minimum of 24 inches.

5.8.4 Vegetative Soil Layer

A 2-foot-thick vegetative soil layer was placed directly over the geofabric surface. The vegetative soil material was obtained from the Route 7 Borrow Area. The vegetative soil layer was placed in loose lifts and was lightly compacted using a low ground pressure bulldozer.

Following placement and fine-grading of the vegetative soil layer, the elevation of the top of the vegetative soil layer was surveyed at a 50-foot grid to assess the thickness of the layer. The results of the grid survey for the CMSD/TSCA Cell vegetative soil layer are summarized in Table 10. The survey results indicated that the average thickness of the vegetative soil layer was 2.4 feet. The provisions of the *Construction Field Samplng Plan* require that either each grid point exhibit a minimum vegetative soil layer thickness of 2 feet or that the entire data set exhibit a minimum thickness of 2-foot at a 95-percent confidence level. As shown on Table 10, eight points did not achieve the required 2-foot thickness (these points each exhibited a thickness of 1.9 feet). However, subsequent statistical analysis indicate that layer achieved a thickness of 2-foot at a 95-percent confidence level. Therefore, the vegetative soil layer thickness achieved the requirements of the *Construction Field Sampling Plan*.

5.8.5 Erosion Protection

The surface of the vegetative soil layer was seeded and mulched, and a series of run-off controls were constructed across the steeply sloping portions of the CMSD. The installed run-off control system conisted of a series of rock berms (using ODOT Type D Rock Fill) that would inhibit sheet flow perpendicular to the slopes, and direct excess run-off to rock-lined discharge chutes. The trapezoidal discharge chutes were lined with a geofabric layer overlain by a 2-foot layer of ODOT Type C Rock Fill.

In addition to the controls described above, additional erosion protection was also installed adjacent to the CMSD along the Ohio River. Prior to rock placement, a non-woven geofabric layer was placed along proposed rock placement area. An approximately 1.5-foot-thick layer of ODOT Type C Rock Fill was placed. The rock erosion protection was placed to approximately elevation 630.

5.9 INSTALLATION OF THE FSPSA SOIL FLUSHING SYSTEM

The approved design documents required the installation of an enhanced infiltration system within the FSPSA, and placement of a vegetative soil cover. Prior to installation of the flushing system, the FSPSA area was regraded to provide grades between approximately 1 and 3 percent.

The FSPSA flushing system consists of three primary components: the flushing water storage tank, the FSPSA pumping and control system, and the flushing water distribution piping. The flushing water storage tanks consisted on an existing 500,000 gallon, above-ground storage tank located on the Ormet Primary Reduction Facility adjacent to the northwest corner of the Superfund Site. Prior to use in the FSPSA flushing system, the tank was cleaned and upgraded by Ormet Primary to serve as the flushing system storage tank. The primary actions involved constructing a water supply connection pipe between the plant production water distribution system, and installing level controls to prevent overfilling.

The FSPSA pumping and control system consisted of a delivery pump, an hydraulic control valve, and timer controls. The installed delivery pump was a centrifugal pump (Carver L&H 3x2.5.10H) capable of delivering approximately 350 gallons per minute at a total dynamic head of 200 feet. The delivery pump was installed on a concrete pad located adjacent to the tank. The pressure delivered to the flushing system was regulated with an installed hydraulic control value (Flowmatic Model C600). The timing and duration of the of water delivery was controlled by an automatic timer (Diehl Model TA 4150).

The pumping and control systems convey the flushing water through 6-inch and 3-inch diameter polyvinyl chloride (PVC) distribution piping to a series of parallel 2-inch diameter supply lines connected to 93 sprinkler heads. Following installation, the entire system of delivery piping was hydrostatically tested at 150 psi for 60 minutes as described in the *Construction Field Sampling Plan* and technical specifications. Copies of pipe testing logs are provided in Appendix D. The sprinkler heads installed as part of the FSPSA delivery system are Super 700 Series as manufactured by The Toro Company. The sprinkler heads are capable of delivering a 45-foot spray radius at a supply pressure of 65 psi. The individual flow rates under these conditions range from approximately 3 to 4 gallons per minute.

Following regrading and installation of the water distribution system, an approximately 6-inch thick vegetative soil cover was placed over the area. The specifications required that the material consist of a silty sand with a permeability between $1x10^{-3}$ cm/sec and $1x10^{-5}$ cm/sec. Due to traficability and flushing system maintenance concerns, Ormet Primary desired to use sand in lieu of the material specified. The material used was obtained from Brown's Gravel Pit in Sardis, Ohio and consisted of a fine to coarse sand. Hydraulic conductivity testing indicated the material exhibited a permeability of $6.3x10^{-3}$ cm/sec. FSPSA cover material testing results are provided in Appendix A. U.S. EPA was informed of this minor revision in correspondence dated October 13, 1997.

Following placement and fine-grading of the vegetative soil cover, the elevation of the top of the vegetative soil layer was surveyed at a 50-foot grid to assess the thickness of the layer. The results of the grid survey for the FSPSA soil layer are summarized in Table 11. The survey results indicate that the average thickness of the vegetative soil layer was 0.7 feet. As shown on Table 11, each grid point exhibited a thickness of at least 6 inches.

In addition to the activities described above, two supplementary components were added to enhance the performance of the FSPSA flushing system. Following periods of heavy rain, surface water was observed to frequently pond in the southern portion of the FSPSA. In order to minimize ponding and thereby deliver additional water to the subsurface, a series of shallow infiltration trenches were installed in the regraded FSPSA material. The infiltration trenches were installed to an approximate depth of 1.5 feet, and were filled with ODOT No. 6 stone. The second improvement involved adding a shallow sump equipped with a small (i.e., 1/3 horsepower) recirculation pump to the southern FSPSA area susceptible to ponding. The recirculation pump conveys the water to the northernmost portion of the FSPSA where the water is discharged to the surface via. a spray-hose.

5.10 CONSTRUCTIION OF SITE FENCING

After substantial completion of construction activities, a chain-link fence system was installed to enclose the FSPSA, CMSD, former CRDA and former Backwater Area. The location of the fencing is depicted on the As-built Drawing, provided as Appendix G. The constructed fence system was 6-foot chain-link fence equipped with three strands of barbed wire. The fence conforms with the requirements of Section 511.12 of the Ohio Department of Transportation Specifications. The fence was installed by Aconomy Fencing.

5.11 SITE RESTORATION

Following completion of the earthwork activities, site restoration activities were implemented. These consisted of removing equipment and debris associated with the construction activities, fertilizing, liming, and seeding and mulching soil areas disturbed by construction. Seeding and mulching activities were performed by Schoenbrunn Hydroseeding, Inc. of Dover, Ohio. These activities were performed utilizing typical landscaping equipment (i.e., mulch/seed blower).

6.0 PRE-FINAL/FINAL INSPECTION

Upon substantial completion of the construction activities, a Pre-Final/Final Inspection was held. The inspection was held on June 11, 1998, and was attended by representatives of the U.S. EPA, the U.S. Army Corps of Engineers, Ormet Primary, O'Brien & Gere, and Dames & Moore. The attendees listed outstanding components of construction, and discussed identified variances between the completed construction and the approved Remedial Design. Areas subject to remedial construction activities were observed and the construction activities were described. Questions raised by the attendees were addressed, and a short list for completion of remaining remedial construction activities was developed.

7.0 VARIANCES FROM THE APPROVED DESIGN

Remedial construction activities associated with the Ormet Primary Superfund site were performed in substantial conformance with the *Final Design Report, Construction Quality Assurance Project Plan,* and *Construction Field Sampling Plan* with no significant modifications or variances observed. The minor modifications/variances that were implemented with U.S. EPA notification and/or approval included:

- The CMSD Seep Collection System was extended around the southern toe-of-slope of the CMSD. This action was performed to capture two isolated seeps that were observed on the riverside (southern) face of the unit.

- During portions of the temporary stormwater diversion berm and Outfall 004 drainage channel construction activities, wet subgrade conditions were encountered. In response to this condition, the initial soil lifts in these areas were placed in thicknesses exceeding the specified maximum 8-inch loose lift thickness. The upper soil lifts of these components were placed and compacted in accordance with the requirements of the technical specifications.

- Several of the Outfall 004 drainage channel invert elevations do not achieve the tolerances (+/- 0.2 feet of design elevation) required by the *Construction Field Sampling Plan.* The channel appears to be functioning effectively and this minor variance is not believed to adversely affect the performance of the Remedial Action.

- Due to verification sampling activities being performed during hot summer days and the site's close proximity to the analytical laboratory, several of the verification sample coolers could not be cooled to the required 4 degree C (+/- 2 degrees) prior to sample log in at the laboratory.

- The Backwater Area isolation berm was left in place and the area was filled with imported soil. The fencing in this area was also revised to accommodate this change.

- Due to soft areas encountered on the TSCA Cell subgrade surface, a geogrid and additional material was added to stabilize the cover system subgrade. These actions were effective in achieving the required subgrade stability and compaction characteristics.

- Due to the volume of material removed from the CRDA and Backwater Area, the design of the TSCA Cell (liner transitions and surface grades) was revised to accommodated this additional material.

- The design of the CMSD cover system was revised to incorporate a synthetic drainage net layer and a 24-inch vegetative cover in lieu of the specified 12-inch drainage layer and 18-inch vegetative cover.

- The interface between the CMSD cover system HDPE liner and synthetic drainage net does not achieve the specified 20.5 degree internal friction angle. Based upon testing results provided by the contractor, the installed materials provide a peak friction angle of 18 degrees, with adhesion of 4 pounds per square foot. Calculations using the test data indicate the as-built CMSD cover system has a minimum factor of safety of 1.36 against sliding, rather than the design value of 1.5.

- A series of shallow gravel trenches and a recirculation pump were installed in the FSPSA to mitigate ponding water in the southern portion of the unit.

- Due to maintenance concerns, the FSPSA cover soil utilized consisted of a sand material in lieu of the specified silty sand material.